

Amendments to the Claims

The following listing of claims replaces all prior versions and listings of claims in this application:

Claims 1. to 18. (Cancelled)

19. (Currently Amended) A method for electroplating a metal deposit on a substrate which comprises contacting a plurality of such substrates with ~~the~~ a solution of claim 1 ~~which comprises:~~

water;

a metal ion in an amount sufficient to provide a metal deposit on a platable substrate;

a complexing agent of an organic compound having between 4 and 18 carbon atoms which compound includes at least two hydroxyl groups and a five or six membered ring that contains at least one oxygen atom, with the compound being present in an amount sufficient to complex the metal ion to render it soluble in the solution and to inhibit oxidation of the metal ion; and

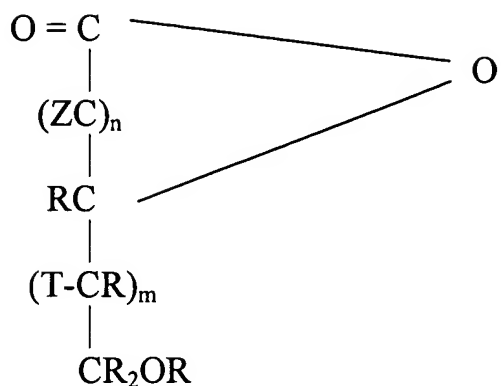
a pH of the solution in the range of between 3.5 and 5.5, adjusted, if necessary, by the addition of a suitable pH adjusting agent;

wherein the complexing agent and metal ion are present in a concentration ratio of between about 2:1 and 9:1 to reduce or minimize agglomeration of the substrates during electroplating; and

passing a current through the solution to provide metal electrodeposits on the substrates without causing significant agglomeration of such substrates during the electroplating.

20. (Cancelled)

21. (New) The method of claim 19, wherein the complexing agent has the structure:



wherein each R is the same or different and is hydrogen or a lower alkyl group of 1 to 3 carbon atoms, T is R, OR, or $\text{O}=\text{P}(\text{OR})_2^-$, Z is $\text{O}=\text{}$ or $\text{RO}-$, n is 2-4 and Z can be the same or different in each occurrence in the compound, and m is 1-3, or the complexing agent is a soluble salt of such structure.

22. (New) The method of claim 19, wherein the complexing agent is ascorbic acid, isoascorbic acid, dehydroascorbic acid, glucoascorbic acid, galacturonic acid, glucuronic acid, or a salt thereof, or is derived from a ketogluconate or heptagluconate and is present in an amount of about 25 to 200 g/l.

23. (New) The method of claim 19, wherein the metal ion is a tin ion and is added to the solution as a stannous alkyl sulfonate salt, a stannous sulfate salt, a stannous chloride salt, a stannous ascorbate salt, or stannous oxide and is present in an amount of between about 5 and 100 g/l.

24. (New) The method of claim 23, which further comprises a divalent lead salt in an amount sufficient to deposit a tin-lead alloy from the solution.

25. (New) The method of claim 19, which further comprises a conductivity salt in an amount sufficient to increase the conductivity of the solution.

26. (New) The method of claim 25, wherein the conductivity salt is an alkali or alkaline metal sulfate, sulfonate, or acetate compound.

27. (New) The method of claim 19, which further comprises a surfactant in an amount sufficient to enhance deposit quality and grain structure.

28. (New) The method of claim 27, wherein the surfactant is an alkylene oxide condensation compound and is present in an amount of about 0.01 to 20 g/l.

29. (New) The method of claim 19, further comprising an agent to promote anode dissolution.

30. (New) The method of claim 29, wherein the agent to promote anode dissolution is as potassium methane sulfonate, ammonium chloride or a metal sulfide salt.

31. (New) The method of claim 19, wherein the substrates are composite articles having electroplatable and non-electroplatable portions, the pH adjusting agent is an acid or a base and the pH is adjusted to the range of about 3.5 to 5.5 to enable electroplating of the electroplatable portions of the articles without deleteriously affecting the non-electroplatable portions.

32. (New) In a method for electroplating a metal deposit on a substrate by contacting a plurality of such substrates with a solution, the improvement which comprises formulating a solution which comprises:

water;

a metal ion in an amount sufficient to provide a metal deposit on a platable substrate;

a complexing agent of an organic compound having between 4 and 18 carbon atoms which compound includes at least two hydroxyl groups and a five or six membered ring that contains at least one oxygen atom, with the compound being present in an amount sufficient to complex the metal ion to render it soluble in the solution and to inhibit oxidation of the metal ion; and

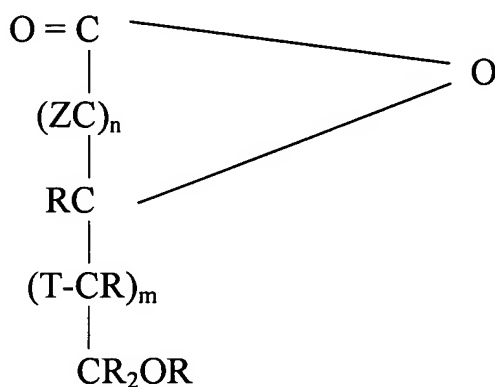
a pH of the solution in the range of between 3.5 and 5.5, adjusted, if necessary, by the addition of a suitable pH adjusting agent;

wherein the complexing agent and metal ion are present in a concentration ratio of between about 2:1 and 9:1 to reduce or minimize agglomeration of the substrates during electroplating;

so that significant agglomeration of such substrates is avoided when a current is passed through the solution to provide the metal electrodeposits on the substrates.

33. (New) The method of claim 32, wherein the metal ions are tin ions and are present in an amount of between about 5 and 100 g/l.

34. (New) The method of claim 32, wherein the complexing agent is present in an amount of about 25 to 200 g/l and has the structure:



wherein each R is the same or different and is hydrogen or a lower alkyl group of 1 to 3 carbon atoms, T is R, OR, or $\text{O}=\text{P}(\text{OR})_2$ -, Z is $\text{O}=\text{}$ or $\text{RO}-$, n is 2-4 and Z can be the same or different in each occurrence in the structure, and m is 1-3, or the complexing agent is a soluble salt of such structure.

35. (New) The method of claim 32, wherein the complexing agent is ascorbic acid, isoascorbic acid, dehydroascorbic acid, glucoascorbic acid, galacturonic acid, glucuronic acid, glucose-6-phosphate, or a salt thereof, or is derived from a ketogluconate or heptagluconate and is present in an amount of about 25 to 200 g/l.

36. (New) The method of claim 32, further comprising one of a conductivity salt of an alkali or alkaline metal sulfate, sulfonate, or acetate compound, or a surfactant of an alkylene oxide condensation compound in an amount of about 0.01 to 20 g/l, or both.

37. (New) The method of claim 32, wherein the substrates are composite articles having electroplatable and non-electroplatable portions, the pH adjusting agent is an acid or a base and the pH is adjusted to the range of about 3.5 to 5.5 to enable electroplating of the electroplatable portions of the articles without deleteriously affecting the non-electroplatable portions.